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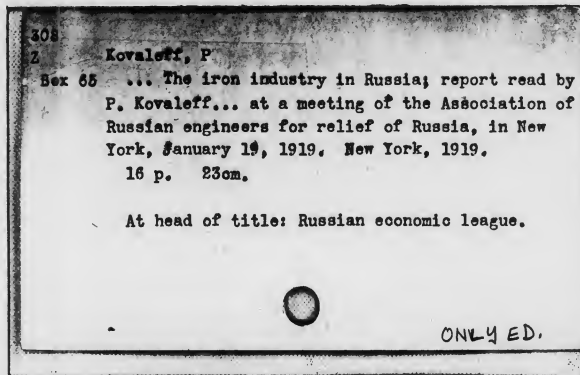
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RUSSIAN ECONOMIC LEAGUE

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The Iron Industry in Russia

Report read by P. KOVALEFF, Mining Engineer,
Member of the RUSSIAN ECONOMIC LEAGUE, at a
meeting of the Association of Russian Engineers for Relief
of Russia, in New York, January 19, 1919.

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Whatever economic subject pertaining to Russia is dealt with, we of necessity—such are the present conditions—have to resort to a number of conjectural assumptions. In my report I shall consider Russia as a political unit in its former boundaries, excepting only Poland, the separation of which from Russia in the form of an independent state presents itself as an accomplished fact. Most of the numerical data which I utilize in my report date back to the year 1913, as the last year in which conditions were normal and as the one that had reflected in the most striking manner the productive capacities of the various iron-manufacturing districts of Russia, because that was the record year for the iron industry of Russia.

Notwithstanding the rapid development of the iron industry in Russia during recent years, especially during the period from 1909 to 1913, when the output of pig iron increased from 3,240,000 tons to 5,040,000 tons, the per capita consumption of iron in Russia was considerably behind that of the other European countries. While for Germany this amount was 319.8 lbs., for Great Britain 269.1 lbs., for France 245.7 lbs., the corresponding figure for Russia was even in the record year only 62.4 lbs. The reason for this is known to all: the lack of development of industries in general, the small activity in railroad building, and particularly the insignificant consumption of iron by the general mass of the population owing to their lack of sufficient purchasing power.

A comparison of the per capita consumption of iron in Russia with that in other countries gives an idea of that iron scarcity which the country really felt constantly, not-

withstanding the crises in the iron industry which were felt now and then, since the crises were caused not by an overproduction of iron as against the needs of the population, but by the mere absence among the general masses of the means wherewith to buy it. At the present time there are all the prerequisites for a fundamental change in this situation in the opposite direction. First of all, the prosperity of the rural population has considerably improved. The accumulation of currency by the rural population was going on all the time during the war, and it is continuing now, because the farm products, though in meagre quantities, still continue to go into cities at high prices, while the money received for them remains in the country, for the simple reason that there is nothing in the cities that a farmer can buy with it. No doubt with the re-establishment of the distribution of merchandise the demand of rural population for the products of the iron industry will be entirely different from that which obtained previously. The mere restoration of the worn-out farming implements which have hardly been repaired from the beginning of the war, will call for an enormous quantity of iron, to say nothing of the increase in demand for iron for improvements in farming equipment, owing to the higher state of prosperity of the villages.

An increased demand for iron must also be expected from industry. The redistribution of the population, accompanied by intense emigration toward the outer regions, particularly to Siberia, must necessarily cause the establishment of a number of new industrial enterprises in those industrially undeveloped parts of Russia. This will call for iron in quantities far in excess of the normal demand.

On the part of the railroads, there also is foreseen a demand for iron considerably greater than before the war. The development of the railroads at the rate of at least 5,000 versts (3,314 miles) of new lines annually is presenting itself as an urgent necessity without which any improvement of the economic situation of Russia is unthinkable. Besides this, enormous quantities of iron will be required for the restoration of the rails, which have not been renewed since the beginning of the war, and also for the

renewal of the rolling stock of the existing railroads.

City building has been almost entirely stopped for the duration of the war. Although lately in Central Russia there has been a flow of the population from big cities to the country, in order to get relief from starvation, and although a certain portion of these refugees probably will remain in the country even after normal conditions of life are restored, nevertheless the population of the small cities in Central Russia, as well as the urban population of Siberia and of other regions not occupied by the bolsheviks, has considerably increased mainly on account of the refugees, and therefore it must be expected that intense building activity will take place in the cities as soon as the opportunity presents itself. This again will create an increased demand for iron, a demand far greater than that of normal times.

I regret that I am not in possession of the numerical data which would enable me to make the corresponding calculations, and in general, as far as I know, there is no statistical material of this kind in existence. Still the foregoing general considerations permit one to assert that with the restoration of the means of communication and transportation and of the circulation of merchandise, the call for the products of the iron industry will considerably, perhaps a number of times, exceed the volume of the market as it was in the years preceding the war.

Now, let us see to what extent this demand can be met by the Russian iron industry.

First of all, let us consider the natural resources of the country which feed this industry; in other words, the deposits of iron ore. In this respect the situation is more than satisfactory. The general reserve of iron ore in Russia, not including Poland, was estimated by the Russian Geological Survey in 1910 at 2,200,000,000 tons, which corresponds to 900,000,000 tons of pig iron (the maximum yearly output of iron ore in Russia does not exceed 9,000,000 tons). Nevertheless the above mentioned estimate of iron ore reserves in Russia must be considered as considerably below the real figures. It expresses only the total of the iron ore reserves in certain deposits, the extent of the explora-

tion of which has permitted expression in definite figures. So, for instance, for all the immense expanse of Siberia, which has been very little explored for iron ores, the amount of the deposits has been estimated at but 27,000,000 tons. This certainly does not represent the actual deposits of Siberia. To what extent this influences the estimated total, is shown by the fact that the explorations made in 1912-1914 of the three iron deposits in the Ural—Blagodatskiy, Bakalskoie and Kamenskoie (a region which has been explored for iron ore more thoroughly than any other part of Russia), raised the estimate of the iron ore reserves for Ural as calculated in 1910, from 282,000,000 tons to almost 400,000,000 tons, or more than 40%.

Besides this, in the above mentioned estimates of the general reserves of iron ore, there have not been included the poorer iron ores (containing less than 40% Fe). However, with the passage of time, the exhaustion of the world's iron-deposits and the development of metallurgical practice will undoubtedly change the conception of "iron ore" and will make possible the profitable smelting of ores which now are not considered as "ore" at all.

This latter consideration, in figuring the distant future, certainly must be given due attention, especially if we take note of the fact that in central and northern Russia (in the provinces of Riasan, Kaluga, Nizhni-Novgorod, Vladimir, Orel, Tula, Vologda, Viatka and Olonetz) low grade iron ore is widely spread.

Therefore, the reserves of iron ore in Russia are more than sufficient for supplying the needs of the domestic market, no matter how colossal these needs may be in the future. And therein lies our advantage over the neighboring European countries, which (as for example, Germany and France) are compelled even now to base their calculations on the exploiting of the low-grade ores of Lorraine.

The presence of fuel together with, or within reach of the ore beds, determines the centers of the development of the iron industry. Further on, when considering the iron regions separately, I shall dwell upon this question more in detail, while here I remark only that with an adequate development of railroad transportation the stores of fuel

are more than sufficient for the development of the iron ore resources of Russia, no matter how intensively this development may be carried on.

In order to make clear to what extent the existing equipment of the metallurgical plants is able to meet the demands of the domestic market, I will, first of all, give the figures on the production of these plants for 1913.

Pig Iron

| | |
|-------------------------------|----------------|
| South Russia..... | 3,420,000 tons |
| Ural | 1,008,000 " |
| Central and North Russia..... | 216,000 " |

| | |
|------------|-------------|
| Total..... | 4,644,000 " |
|------------|-------------|

Iron and Steel

| | |
|-------------------------------|----------------|
| South Russia..... | 2,538,000 tons |
| Ural | 738,000 " |
| Central and North Russia..... | 666,000 " |

| | |
|------------|-------------|
| Total..... | 3,942,000 " |
|------------|-------------|

Besides this, the same year, there was imported from abroad:

| | |
|-----------------------------|-------------|
| Pig Iron | 36,000 tons |
| Wrought Iron and Steel..... | 504,000 " |

Of the last item, machines, apparatus, parts for same, etc., were 342,000 tons.

Hence, the total consumption in 1913 was:

| | |
|---------------------|----------------|
| Pig Iron | 4,680,000 tons |
| Iron and Steel..... | 4,446,000 " |

In order to show how much the output of the metallurgical plants that year was below their capacity, I may point to the data on the blast furnaces that were operating, idle, or in process of construction that year.

| | Operating | Idle | Constructing |
|-----------------------------|-----------|------|--------------|
| South Russia | 50 | 11 | 5 |
| Ural | 73 | 52 | 1 |
| Central and North Russia... | 17 | 29 | 0 |
| Total..... | 140 | 92 | 6 |

The average output of one blast furnace for the year was:
South Russia

Ural 14,274 tons
 Central and North Russia 13,500 "

Allowing that 10% of the blast furnaces will constantly be undergoing repairs, or for some other reason will not be operated, we can estimate that the operating of the blast-furnaces which were idle, or under construction in 1913, could give the following quantity of pig iron above the quantity produced in that year.

| | Average per furnace tons | Total of furnaces | Idle furnaces in operation | Furnaces in operation | Output of pig iron tons |
|---------------------------------------|--------------------------------|----------------------|-------------------------------|--------------------------|-------------------------------|
| South Russia | 69,822 | 16 | 7 | 9 | 628,398 |
| Ural | 14,274 | 53 | 13 | 40 | 570,960 |
| Central and North Russia | 13,500 | 29 | 5 | 24 | 324,000 |
| Total | | 98 | 25 | 73 | 1,523,358 |

Consequently, the existing equipment of the blast furnace plants would suffice to bring the smelting of pig iron up to approximately 6,000,000 tons, which would exceed the maximum of production reached up to this time by almost 30%. To work over this quantity of pig iron into wrought iron and steel will present no difficulties, because the output of the rolling mills was always below their capacity to a considerably greater degree than was the case in the blast furnace plants.

Taking into consideration the import from abroad in 1913, it will be observed that the output of iron for the domestic market can still be increased above the quantity absorbed in 1913 by 791,000 tons ($.85 \times 1,523,000 + 3,942,000 - 4,446,000 = 791,000$ tons), in other words by approximately 18%, if nothing at all is imported from abroad.

Of course, the putting on the market of the extra 791,000 tons of iron and steel will be far from meeting the acute need for these products, which is going to be felt in the country for a number of years. Therefore, there is the necessity of finding other ways of meeting this demand. These ways are: (1) import from abroad, (2) the development of the existing regions of iron industry, and (3) the opening up of new regions.

It is entirely clear that the first way is not the most

desirable from the standpoint of the country's economics in general, and in view of the existing situation would be accompanied by great difficulties. But of course it will have to be resorted to in the beginning, strictly within the limits of necessity; in other words, exclusively for procuring the machinery and implements for farming and also the means of transportation. The importation of other products of the iron industry would be, in view of present conditions, a luxury which we can not afford.

The second and the third ways are the most attractive from the standpoint of the country's economic welfare and to attain the object by these two methods no efforts should be spared. The period of reconstruction and of the rehabilitation of the country's industries lends itself exceedingly well to this. Before the war the development of certain regions was held back by the limited capacity of the market and by the rivalry and the competition of the separate regions that were striving to control the market. But now the situation is entirely changed, and the iron market can not be saturated for many years. Under such conditions, all private initiative and enterprise in the sphere of developing iron industry will bring rich returns on the capital and the efforts devoted to it, without any risk whatever or worry over the disposition of the manufactured products. It is self evident that Russian capital, as much as may be salvaged after the Bolshevik calamity is over, as well as foreign capital, will gladly invest in the iron industry, and, consequently, the degree and the rapidity of the development of various regions will be determined mainly by their natural resources and by the development of the means of transportation.

Let us consider from this viewpoint two principal iron manufacturing regions of Russia: South Russia and the Ural. I do not dwell on the Central and Northern regions, because of the impossibility of working on a large scale the local low grade ores, the beds of which are so distributed that they permit working only on a small scale and in a more or less primitive manner. For this reason we must consider these regions only as the sources for satisfying the needs of the local markets.

The region in South Russia is the largest region of the iron industry in Russia. It furnished in 1913 about 3,420,000 tons of pig iron and 2,538,000 of wrought iron and steel. Regarding the deposits of ores in the Krivoi Rog region, on which the whole Southern region is mainly dependent, ten years ago there was much apprehension, because these ore deposits, as they were known at that time, were estimated at several tens of millions of tons, a quantity which with the steadily increasing yearly mining, reaching in 1913 7,000,000 tons, would secure a supply of ore to the southern plants for not more than ten years. Nevertheless, the southern region since that time has been working ten years, and the explorations made during this period have dispelled all such fears. At the present time the reserve of ore unmined in Krivoi Rog is estimated at over 400,000,000 tons, and the explorations open up new ore-beds every year. Besides, as a supplementary supply for southern plants, there is a reserve of about 500,000,000 tons of ores on the Kerch Peninsula. These deposits, though lower in grade (about 40%), are of larger formation—large and thick strata—which condition permits power excavation. These ores could be mixed with those of Krivoi Rog for smelting.

Regarding the deposits of coking coal in the Donetz basin, apprehensions lest they become rapidly exhausted, were also expressed, based apparently on the considerations that these are the very deposits that have been most intensively mined. However, the estimate of the deposits of coal in the Donetz region made by the Russian Geological Survey, dispels these apprehensions. Out of the total deposits of pit coal in this region, which are more than 55,000,000,000 tons, the proportion of coals belonging to groups I-IV of Gruener's scale, including coking coal, is about 18,000,000,000 tons. If we compare with this the fact that since the discovery of the Donetz coal basin up to the present time the total quantity of above mentioned coal mined is estimated at not over 300,000,000 tons, which is less than 2% of the total deposits, then we can see clearly that the time to speak of the exhaustion of the coke deposits in the Donetz region has not yet arrived.

Of all the iron regions the South Russian region has the best developed railroad connections. This fact and also the possibility of using mineral fuel for smelting pig iron enabled this region to develop production rapidly. That is why in a period from 1910 to 1913, the production of pig iron in South Russia had risen from 2,268,000 tons to 3,348,000 tons, or an average yearly increase of 270,000 tons. This fact puts the South Russian iron producing region in a particularly important position as a source for satisfying the needs in iron during the first stages of reconstruction.

The second place in importance in the developing of the iron industry belongs to the Ural region, which in 1913 produced 1,008,000 tons of pig iron and 738,000 tons of wrought iron and steel. This region is exceptionally rich in iron, having in abundance remarkably pure and easily smelted ores, the deposits of which are estimated at nearly 400,000,000 tons. Vast stretches in Southern and Northern Ural are still unexplored, and geological data furnish a basis for the belief that further prospecting and exploration will lead to a discovery of additional deposits of iron ores.

With regard to fuel, the Ural region is not so favorably situated. Deposits of coking coal which could be utilized in the Ural region have not thus far been discovered, and this region is carrying on the smelting of pig iron exclusively with charcoal. This fact in connection with the remarkable purity of the iron, enables Ural plants to produce a pig iron of high quality, which is particularly adapted for manufacturing high grades of steel, with which only Swedish pig-iron can compete. But at the same time, the necessity of smelting with charcoal is a drawback, inasmuch as the volume of production is limited by the growth of forest in the districts accessible to forest exploitation. Furthermore, the efficiency of charcoal blast furnaces is considerably below that of the coke blast furnaces. As can be seen from the foregoing data, the average productivity of the Ural blast furnaces in 1913 was 14,274 tons, while the same figure for South Russia was 69,822 tons, or 5 times as much.

The backwardness of railroad development in the Ural also hinders the development of the iron industry in this

region in a degree corresponding to the natural mineral wealth of this region. In this connection it will be sufficient to point out that while some plants on the eastern slopes of the Central Ural, which are less well provided with ore than the others, were compelled to curtail their production, at the same time the richest deposits of magnetite of Magnitnaya Mountain in South Ural, estimated at 37,500,000 tons, remained almost untouched, from a lack of railroad communication, and only at the time of the war was the building of a line connecting it with the Samara-Zlatoust R. R. undertaken. Also the rich Komarovskiy and Zigazinski deposits, and a number of other deposits in South Ural remain cut off from the railroad. A railroad line built across the Ural crest from Magnitnaya Mountain toward the town of Sterlitamak would connect all these deposits with the railroad system and call into existence a series of new iron producing plants.

Therefore, under the circumstances, the Ural is not in a position to develop its production as rapidly as South Russia. If we consider the same four-year period of exceedingly favorable market conditions, 1910-1913, we see that while South Russia increased its yearly output of pig iron in that period by 1,080,000 tons, the increase for the Ural in 1913, as against 1910, was only 306,000 tons, but as against the year 1900, the year of the preceding maximum production (900,000 tons)—only 108,000 tons. Consequently all that we can expect from the Ural to start with, would be the renewal of the activity of the idle blast furnaces, and an increase of output by not more than 500,000—600,000 tons above the output of 1913.

It is true that such a volume of activity would be altogether inadequate to the demands made upon this region commensurate with its mineral wealth; and the way out of this situation would be the smelting of the Ural ores with the coking coal of Western Siberia, which would allow the development of the iron industry on a large scale. The completion of the South Siberian line and its extension eastward in the direction of Slavgorod and Barnaul till it connects with the Kolchugin branch will undoubtedly be the turning point in the history of the Ural iron industry, as

then the iron ore deposits of the South Ural will be connected with Ekibastus coal deposits and with the Kuznetsk coal basin which contains coking coal. And the coal deposits in the Kuznetsk basin alone are, at any rate, no less than those in Donetsk basin, but are probably considerably greater. In the time of the war the supplying of the Ural with Siberian coal was started, and for this, the Suodjensky coal deposits were drawn upon, but the volume of this supply could not be large on account of the limited carrying capacity of the Siberian Railroad.

Therefore the proper development of the Ural railroad system itself, as well as of the lines connecting this region with the West Siberian coal deposits, will enable the Ural to show the same proportionate growth of the iron industry as has been observed in South Russia.

The development of new regions of iron industry is to be expected in the outlying regions of Russia—in Siberia and in the Caucasus. Immediately preceding the war there was no iron industry in these districts at all. In 1875, the only iron manufacturing plant in the Caucasus, the Chatahsky Iron Manufacturing Plant, ceased to exist, and in 1911 had been shut down the last of the Siberian plants, the Abakansky (though after the war started, the Petrovsky plant, in the Nerchinsk district resumed its activity on a small scale). Such a situation is due to the small capacity of the Siberian market and to the impossibility for the small Siberian plants without railroad connections to compete with the iron regions of European Russia which have a firmly established position. A radical change in the situation, as has been explained above, has already begun.

Regarding the Caucasus, it will be noted that it is poorer in iron than in copper, zinc, lead and silver ores. But it is noteworthy that this region has been very little explored for iron, although within the boundaries of the provinces of Elizavetpol and Kuban are found a number of indications of the presence of iron ores. Definite data have been obtained at the present time only regarding two deposits. One, the Chatahsky, about 6½ miles from Tiflis, contains 1,000,000 tons of 60% hematite; and the other, the Dashkessan, about 20 miles from Elizavetpol, a deposit of

iron ore (60% magnetite), estimated at 13,000,000 tons. So considerable a deposit can serve as a basis for a sizable metallurgical plant.

Coking coals have not up to this time been mined in the Caucasus. However, they are found in the so-called Tkarchelsky deposit, the size of which is estimated at over 200,000,000 tons. This deposit is within 25 miles of the Black Sea coast and of the Chernomorskaya Railroad. It would be sufficient therefore, to build a short branch railroad in order to solve the problem of supplying coke for smelting the Caucasian ores.

In Siberia, several future centers of iron industry are being definitely indicated, provided with iron ore and with coking coal. The source of the latter is the West Siberian coal deposits, particularly the Kuznetsk basin. At the south-eastern border of this basin, near Lake Teletsk are deposits of 68% magnetite, the extent of which is estimated at 25,000,000 tons, which alone would guarantee the operation of a large iron producing enterprise.

Within the boundaries of the Kirgiz steppes, northward and southward from Karkaralinsk, there are indications of the presence of iron ores, which, on account of their variety as well as of their high content (hematite and magnetite containing 60-63% Fe) deserve serious consideration. The limited exploration of these deposits does not permit an estimate in figures of their extent, but the character of formation of some of them, in thick ore bodies (Ak-Tau) and in seams (Konstantinovskoye, Mikhailovskoye) indicates that it is considerable. As to fuel for smelting these ores, the Ekibastus or Kuznetsk coke can be used.

Within the boundaries of the Yenisei province, on the eastern slopes of the Kuznetsk Alatau and further eastward in the Minusinsk steppe and to the east of the river Yenisei, stretches a series of iron ore deposits, predominantly of magnetite. The best explored among these are: Abakan-skoye, with about 3,000,000 tons of 70% magnetite, and Irbinskoye, with about 8,000,000 tons of the same ore. A railroad line from Kuznetsk to Minusinsk and further toward the northwest, if built, would cross the whole

series of these deposits and would give them access to the Kuznetsk coke.

In Irkutsk province, the iron ore deposits (magnetite, 58-65% Fe) stretch northward from the line of the Siberian Railroad along the river Angara and its tributary the Oka. On these deposits there was founded in 1846 the Nikolaevsk plant, which ceased to operate in 1899. The amount of ore in the four deposits that were worked was estimated at more than 3,000,000 tons. Besides this, in the same region are known a number of other ore deposits which have not been worked or explored. All these together undoubtedly indicate an ore bearing district.

Should there be a railroad line built between Tulun and Ust-Kut, it would pass through the described district and would make it possible to smelt the ores of the Nikolaevsk district with the Kuznetsk coke. Moreover, the location of the deposits along the river Angara permits the transportation of the ore by water down this river which approaches Siberian Railroad line near the Cheremhovskoy coal district, some of the coal of which gives coke. The cheapness of transportation by water of the ore to this district and the proximity of the city of Irkutsk lead one to assume that the place of smelting of the Nikolaevsk ores will be concentrated exactly here.

On the Far Eastern Coast, a considerable center of iron industry is indicated in the Primorskaya (Maritime) province, near Olga Bay and Vladimir Bay, where a number of deposits of magnetite with up to 60% Fe are known. The amount of ore in three of them, Bielogorsky, Vladimirsky and Mramorny Mys (Marble Cape) is estimated at about 6,000,000 tons.

With regard to fuel for smelting, the Olga Bay deposits are in a very advantageous position. The sea route connects this point with the Sakhalin coal deposits, in which there are excellent coals containing little sulphur and giving little ash residue.

Therefore although the Siberian iron ore deposits are thus far but little explored it is nevertheless possible to indicate a number of regions where the development of the iron industry is a question of the not distant future. It

must be noted that the whole north of Siberia is a region totally unexplored with regard to iron ores. Nevertheless in some localities the presence of iron ores is an undoubted fact, as for instance, in Yakutsk province, where there is even now an iron industry in primitive state among the native Yakutsk who are smelting iron in bellows-furnaces.

In concluding my report, I will briefly summarize its conclusions as follows:

1. With the re-establishment of normal economic life in the country there will at once be created a demand for the products of iron industry, a demand exceeding considerably, and perhaps many times, the consumption of those products before the war.

2. The natural resources of Russia in iron ores and coal make possible a development of the iron industry sufficient to meet fully the need in iron, no matter how great that may be.

3. The present equipment of metallurgical plants will permit an increase of the production of iron by not more than 18% of the consumption in 1913.

4. Beyond this the growth of the market for iron, as compared with 1913, can in the first stages of reconstruction, be satisfied only by the development of the South-Russian plants and by importation from abroad.

5. The development of the production of pig iron on a large scale in the Ural region is quite feasible after completing the South Siberian Railroad and building some other railways, connecting the Ural with coal deposits in Western Siberia.

6. At the present time there can be indicated the following centers of the iron industry in Siberia:

- (a) The region of Karkaralinsk.
- (b) Teletsk.
- (c) Minusinsk district in Yenesei Province.
- (d) Nikolaievsk district, in Irkutsk Province (or Cheremhovski district).
- (e) Olga Bay district, Maritime Province.

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